

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Arrangements for Determining the Moisture Content of Solid Substances by means of Neutron Irradiation

We, RHEINISCHE KALKSTEINWERKE G.m.b.H., a body corporate organised and existing under the laws of Germany, of 5603 Wulfrath, Wilhelmstrasse 77, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to arrangements for determining the moisture content of solid substances by means of neutron irradiation.

The complete specification of our patent No. 1063477 described and claims such an arrangement which comprises a fast neutron source in combination with a thermal neutron counting device, the combination being located in a cavity which is at least partially defined by the solid substance the moisture content of which is to be determined. The solid substance under examination is adjacent to and bounded at least partially by solid hydrogen-containing reflecting material which is capable of reflecting neutrons, whereby a proportion of the fast neutrons emanating from the source are slowed down by interaction with solid substance under examination and with the reflecting material to thermal energies and are then detected by the neutron counting device.

According to the present invention an arrangement for determining the moisture content of solid substances by means of neutron irradiation, comprises in combination a fast neutron source and a thermal neutron counting device, said combination being located in a cavity at least partially defined by the solid substance under examination, and the substance under examination being adjacent to a solid hydrogen-containing reflecting material capable of reflecting neutrons, whereby a pro-

portion of the fast neutrons emanating from the source are slowed down by interaction with the substance under examination and with the reflecting material to thermal energies and are then detected by the neutron counting device, the neutron counting device being screened from the reflecting material by a material which absorbs thermal neutrons.

The material of the screen preferably comprises cadmium, boron, gadolinium or compounds or alloys of these elements, whilst the balance of any such alloy may be iron or aluminium.

By means of the present invention the neutrons of thermal energy which are reflected by the reflecting material directly towards the neutron counting device are absorbed by the material of the screen and therefore not recorded by the neutron counting device. On the other hand the neutrons of thermal energy reflected by the substance under examination are recorded by the neutron counting device as the material of the screen merely shields the neutron counting device from the reflecting material.

The invention has the effect of considerably improving the measuring sensitivity of the arrangement. For example, in determining the moisture content of coke in an arrangement according to the invention with a screened neutron counting device, 2,500 pulses per unit time were measured at 0% humidity and 3,200 pulses per unit time at 3% humidity, whereas when the screen was removed, but the arrangement was otherwise the same, the numbers of pulses were 19,500 and 20,500 respectively. The effect therefore is a clear increase in measuring sensitivity.

Preferably the cavity is appreciably larger than the neutron source or the counting device, whilst the spacing between the neutron

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[Price]

source and the neutron counting device may range from substantially zero to a desirable maximum of 20 cm. The distance from the neutron source and the neutron counting device to the substance under examination will generally be approximately 5 to 20 cm.

The substances under examination may for example be contained in a chute, tube or shaft, or be carried on a conveyor belt.

10 The neutron counting device may be a counting tube, or some other suitable detector of thermal neutrons, such as a scintillation counter, fission chamber or ionisation chamber. A plurality of counting devices, and/or neutron sources may be employed in one arrangement.

One example of an arrangement in accordance with the present invention is illustrated diagrammatically in the accompanying drawing, to which reference is now made.

20 The arrangement comprises a thermal neutron counting tube 2, a source 3 of fast neutrons, a cavity 4 in which the counting tube 2 and the source 3 are arranged, and a hydrogen-containing reflecting material 5. The cavity 4 is adjacent to the bulk material 1 the moisture content of which is to be measured.

30 In accordance with the invention the counting tube 2 is shielded from the reflecting material 5 by a screen 6 which prevents neutrons of thermal energy passing directly from the reflecting material 5 to the counting tube 2.

35 The invention may of course be applied to other configurations, such as those illustrated in the drawings accompanying the Complete specification to our patent No. 1063477.

WHAT WE CLAIM IS:—

1. An arrangement for determining the moisture content of solid substances by means of neutron irradiation, comprising in combination a fast neutron source and a thermal neutron counting device, said combination being located in a cavity at least partially defined by the solid substance under examination, and the substance under examination being adjacent a solid hydrogen-containing reflecting material capable of reflecting neutrons, whereby a proportion of the fast neutrons emanating from the source are slowed down by interaction with the substance under examination and with the reflecting material to thermal energies and are then detected by the neutron counting device, the neutron counting device being screened from the reflecting material by a material which absorbs thermal neutrons. 40
2. An arrangement according to claim 1 wherein the material of the screen comprises a compound or alloy comprising cadmium, boron or gadolinium. 45
3. An arrangement according to claim 1 wherein the material of the screen comprises an alloy of cadmium, boron or gadolinium with iron and/or aluminium. 50
4. An arrangement of determining the moisture content of solid substances by means of neutron irradiation, the arrangement being substantially as hereinbefore described with reference to the accompanying drawing. 55

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COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of
the Original on a reduced scale*

